REMARKS

Claim 13 has been added in order to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention. No new matter has been added.

Claims 1, 4 and 7 have been rejected under 35 USC 103(a) as being unpatentable over JP '353 in view of JP '255. Claims 5 and 6 have been rejected under 35 USC 103(a) as being unpatentable over JP '353 in view of JP '255. Claims 1 and 4-12 have been rejected under 35 USC 103(a) as being unpatentable over JP '353 in view of JP '255. Claim 6 has been rejected under 35 USC 103(a) as being unpatentable over JP '353 in view of JP '255 and further in view of JP '897. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

As discussed previously, the instant invention is directed to a method of manufacturing a high-strength aluminum alloy extruded product which has excellent corrosion and stress corrosion cracking resistance. The method comprises a step of continuously extruding a billet of an aluminum alloy comprising, in weight percent, 0.5-1.5% of silicon, 0.9-1.6% of magnesium, 1.7-2.5% of copper, while satisfying four specified relationships among the copper, magnesium and silicon, and further comprising 0.5-1.2% of manganese, with the balance being aluminum and unavoidable impurities, into a solid product by using a solid die having a bearing length of 0.5 or more and the bearing length and thickness of the solid product to be extruded have the relationship of the bearing length being ≤ 5 times the thickness of the solid product to be extruded, to obtain the solid product in which a fiber structure accounts for 60% or more in area-fraction of the cross-sectional structure of the solid product. A flow guide is provided in front of the solid die, an inner circumferential surface of the guide hole of the flow die is separated from an outer circumferential surface of an orifice

which is continuous with the bearing of the solid die at a distance of 9-15 mm, and the thickness of the flow guide is 5-25% of the diameter of the billet.

The present invention provides a high-strength aluminum alloy extruded product having a fibrous structure accounting for at least 60% in area-fraction of the cross-sectional structure of the product which gives the product superior mechanical properties. In the present invention, it is essential to have the composition of the materials used to form the extruded product and the dimensions of the die, as well as various parts of flow guides, applicable when a product is extruded using a die alone or using a die together with a flow guide attached thereto, in order to obtain the superior extruded product of the present invention. Additionally, objective evidence of record supports the unobviousness of the presently claimed invention. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

JP '353 is concerned with increasing the strength of a worked product in which an ingot of an aluminum-copper alloy containing specified weight percentages of copper, manganese, magnesium and silica is subjected to specified treatment steps comprising the heating of the ingot to a specified temperature range at a specified rate of temperature increase, holding the ingot at this temperature for a specified time period, heating the ingot to another specified temperature range, holding the ingot at this temperature for a specified time period and then cooling the ingot to a specified temperature at a specified cooling rate. This reference discloses that these process steps inhibit the extinction of the fiber structure attendant on the progress of recrystallization after aging treatment or an expanded aluminum-copper base aluminum alloy material.

While JP '353 is concerned with providing an aluminum-copper alloy extruded product having a high strength, the present invention is concerned with providing an aluminum-copper-magnesium-silicon alloy extruded product having both a

high strength and high corrosion resistance. In JP '353, the aluminum-copper alloy contains a copper content as high as 4.5% in order to give it its high strength. In the present invention, the aluminum-copper-magnesium-silicon alloy is given a high strength by its method of preparation with the apparatus limitation of the flow guide being provided in front of the solid die, inner circumferential surface of a guide hole of the flow guide being separated from an outer circumferential surface of an orifice which is continuous with the bearing of the solid die at a distance of 9-15 mm and the thickness of the flow guide being 5-25% of the diameter of the billet.

JP '353 does not disclose a specific alloy composition falling within the scope of the present claims and, as admitted by the Examiner, does not disclose the apparatus limitations. However, as discussed above, the apparatus limitations are a critical feature of the present invention.

In the Response filed on March 23, 2007, Applicants presented test data in which alloy compositions 1 and 8 in JP '353, which are the closest to that of the present invention with the exception that the silicon content is outside of the scope of the present claims, is tested against alloys B and F of the present invention. The process of T6 temper of the extruded alloys are almost the same as follows.
JP '353: extrusion (round bar) - solution treatment (500°C × 2h) - WQ - T6 (170°C × 6h)
Present invention: extrusion (rectangular shaped solid bar) - solution treatment (540°C) - WQ - T6 (175°C × 8h)

Table A

	Alloy No.		Alloy No.	
	B	1	F	8
Tensile strength	460 MPa	35kg/mm2 (343 MPa)	480 MPa	40kg/mm2 (392 MPa)
Yield Strength	420 MPa	32kg/mm2 (314 MPa)	425 MPa	35kg/mm2 (343 MPa)

As illustrated in Table 1 above, the alloys of the present invention have an unexpectedly higher tensile and yield strength than the alloys of JP '353. This is due to the apparatus limitations and compositional requirements of the present claims. The secondary references cited by the Examiner do not suggest that such advantages could be gained by modifying the primary JP '353 reference in a manner that would yield the presently claimed invention.

JP '255 discloses a member that can be used to form an automobile brake which has no cracking and satisfactory strength. The member is formed from a billet of an aluminum alloy having a composition containing, by weight, 0.3 to 0.8% silicon, 0.7 to 1.3% magnesium, 0.1 to 0.5% copper, 0.05 to 0.7% iron, 0.05 to 0.2% manganese, 0.01 to 0.4% chromium and the balance being aluminum with inevitable impurities. This reference further discloses that the billet is subjected to extrusion working via a flow guide 23 and a die 24 to produce the member for the automobile brake. The inner circumferential surface face 23a of the flow guide 23 is constituted to be separated from the outer circumference of the orifice 24a of the die 24 by at least 20 mm to the circumference. The thickness of the flow guide 23 is controlled to 5 to 25% of the outer diameter of the flow guide 23 and the extrusion working is performed at a product rate of 3 to 5 meters per minute. This reference has been cited by the Examiner as teaching a similar flow guide for extruding a similar aluminum alloy to that of the present invention.

A readily apparent difference between the alloy disclosed in JP '255, which is an aluminum-magnesium-silicon 6000 series alloy containing copper in an amount of from 0.1 to 0.5%, is that the present invention is directed to an aluminum-copper-magnesium-silicon alloy containing copper in an amount of from 0.8 to 2.5%. The copper alloy content in JP '255 and that of the present invention do not even overlap and the higher content level of 0.5% of the copper content in JP' 255 is less

than the lower limit of 1.7% required in the present claims by 1.3%. This is more than an unobvious difference and one of ordinary skill in the art of metallurgy would expect these two different alloys to have very different properties.

With respect to the Examiner's assertion in the outstanding Office Action that JP '255 teaches a flow guide similar to that of the present claims and discloses apparatus limitations sufficiently similar to those of the present invention in order to make the presently claimed invention obvious, Applicants once again direct the Examiner's attention to the Declaration Under 37 CFR 1.132 of record in the present application. In the previously filed Declaration, the inner circumferential surface of the guide hole of the flow guide being separated from an outer circumferential surface of the orifice which is continued with the bearing of the solid die was set at a distance of 4 mm, 5 mm, 9 mm, 12 mm, 15 mm and 17 mm. Other than that, the extrusion conditions were identical.

As shown in Table 2 and discussed in the results in this Declaration, Specimen No. 1 was extruded using a flow guide with an insufficient dimension for the distance A which resulted in the aluminum alloy billet being extruded under an excessively high temperature which lead to recrystallization in the surface layer and prevented the material from obtaining satisfactory strength. The extruded product developed cracks and the inner granular corrosion test and the stress corrosion cracking test could not be performed. Specimen No. 6 was extruded with a flow guide of 17 mm and developed a problem that when a successive billet was supplemented to a former billet for continuous extrusion, the end of the former billet was cut. The end of the former billet was easy to deform and when the successive billet was supplemented to the end of the former billet and extruded, air was captured where the two billets were joined which lead to an increase in inferior parts of the product and decrease in the yield rate. Specimen No. 2 was extruded using a flow guide with a distance A of

5 mm. The extruded product had a smaller area ratio of fiber structure and higher corrosion weight loss than that of Specimen No. 3 which utilized a flow guide with a distance of 9 mm according to the lower limit of the present invention. This clearly establishes the criticality of the presently claimed flow guide parameters in the present invention and is more than sufficient to rebut a showing of prima facie obviousness.

JP '897 has been cited by the Examiner as teaching an aluminum alloy with a composition range overlapping the composition range of the presently claimed invention and illustrating the extrusion of the alloy into triangular tubing for bumper members. However, the copper content of JP '897 does not overlap that of the presently claimed invention. JP '897 has an upper limit of 1.2% copper in the alloy disclosed there. In contrast thereto, the presently claimed invention has an upper limit of 1.7% copper. A difference in copper content of at least 0.5% is a clearly unobvious difference as one of ordinary skill in the art would not expect that aluminum alloys containing such a different copper content would have similar properties. Therefore, JP '897 adds nothing to the previously discussed references with respect to the presently claimed invention.

If the Examiner will review the Examples contained on pages 19-44 of the present specification, the Examiner will see that more objective evidence is of record in the present application to rebut any showing of prima facie obviousness under 35 USC 103(a). In Table 3 on page 25 of the present specification, alloy compositions outside of the scope of the present claims but falling within the scope of the alloy compositions disclosed in the prior art are shown. As shown in Table 4, these alloy compositions were inferior to those of the present invention. In Comparative Example 2, starting on page 28 of the present specification, Specimen Nos. 29-34 were extruded with bearing lengths outside of the scope of the present claims. As shown in Table 6 on page 31 of the present

specification, each of these specimens were deficient in at least one of the evaluation tests for strength, corrosion resistance, and stress corrosion cracking resistance. In Comparative Example 3 on page 36 of the present specification, alloys were used which were outside of the scope of the present claims but falling within the scope of the prior art references cited by the Examiner. As shown in Table 9, these alloys had inferior properties to those of the present invention. In Comparative Example 4, Specimen Nos. 65-70 were treated outside of the scope of the present claims and also had inferior properties as compared with alloys within the scope of the present claims. This test data is more than sufficient to rebut any showing of prima facie obviousness under 35 USC 103(a) made by the Examiner.

The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,

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